

Voice and Instrument at the Origins of Music

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During the summer of 2008, archaeologists uncovered some remnants of musical prehistory in the caves of Hohle Fels, Germany. There, among burnt animal bones and flint-knapping debris, they found fragments of three flutes (Conard, Malina, and Münzel 2009). One was remarkably complete. This delicate instrument, discovered in twelve pieces, had been fashioned from a vulture's wing bone. It was thirty-four centimeters long (roughly the length of a piccolo), with several finger holes and a notched mouthpiece (like the Japanese *shakuhachi* and other end-blown flutes; see Figure 1). The other flutes at the site were less complete but represented more complex manufacturing. They were made from pieces of mammoth tusk that had been split, hollowed out, and then rejoined. Yet headlines about the Hohle Fels flutes focused on neither their present condition nor their refined construction. Instead journalists and scholars emphasized the artifacts' age. These flutes were more than thirty-five thousand years old—the earliest musical instruments then known.¹ Incidentally, one of the earliest examples of figurative art, an ivory sculpture called the “Venus of Hohle Fels,” was found less than a meter away from the bone flute (Conard 2009). Together these artifacts give compelling evidence for musical and artistic practices in the Upper Paleolithic Era. Writing and the wheel, by contrast, would not appear until almost thirty thousand years later, during the early Bronze Age (that is, around the fourth millennium BCE).



Figure 1: Bone flute from the caves of Hohle Fels. Photo © H. Jensen, Universität Tübingen. Used with permission.

Of course, such evidence is always incomplete, and these instruments reveal only traces of Paleolithic music making. Their sounds and social functions have not been preserved. They are tokens of a culture that can be reconstructed only provisionally, through a kind of principled speculation. For example, given the flutes' technological

sophistication, it is unlikely that they are the first instruments of their kind. Earlier specimens have surely been lost, presumably including instruments made from less durable materials. Indeed, a multidisciplinary review of archaeological evidence for the emergence of music, language, and symbolic behavior concludes that

such instruments must, even at around 35,000 years, be several conceptual stages removed from the earliest origins, even of instrumental musical expression, to say nothing of those universal vocal, manual–percussive and dance forms which must have existed independently of—and before—any need for such tools. (d’Errico et al. 2003, 46)

“And before.” With this aside, the review’s twelve coauthors suggest that musicality originated with the body alone, that instrumental play came after singing. This claim is ubiquitous in writings on music and human evolution. Ian Cross (2007, 663), for example, argues that “the use of musical artifacts will have been preceded by the expression of musical capacities by voice and body.” The idea has a long history. Charles Darwin himself wrote, “With man song is generally admitted to be the basis or origin of instrumental music” (1871, 2:333). But this idea already appears in the eighteenth century in Jean–Jacques Rousseau’s reflections on human and musical origins.

This essay critically examines claims for the precedence of voice in musical prehistory, juxtaposing Rousseau and twenty–first–century authors. Though centered on music and evolution, this investigation more generally explores voice–instrument relations and their implications for a philosophy of musical technology—or, more precisely, musical “technics.” The term “technics” refers to technical matters in the broadest sense. It is an English equivalent to the German “*Technik*” or the French “*la technique*,” which, depending on context, may be translated as either “technique” or “technology.” Lewis Mumford’s (1934) *Technics and Civilization*, for example, explores the interplay of technology and technique, bringing out continuities between hand tools and machines. Technics thus includes—but is not limited to—modern technology. Philosophical work on technics, combined with research from paleoanthropology and psychology, will help complicate narratives of vocal precedence. They will suggest that music is essentially technical and that vocal and instrumental capacities emerged together.

Rousseau on Human Origins

Jean-Jacques Rousseau's 1755 *Discourse on the Origin of Inequality* is concerned, more generally, with the origin of humanity. "For how can the source of inequality among men be known," asks Rousseau (1992, 12), "unless one begins by knowing men themselves?" To access humanity's original state, the philosopher adopts a strategy that is common to other eighteenth-century writers: an anthropological fiction (e.g., Condillac 1746; see Thomas 1995, 45). He uses an imagined past to explore society and culture, law and freedom, language and music. Rousseau sometimes bolsters this narrative with quasi-ethnographic evidence or claims for natural truth. But he can also be refreshingly clear about his speculations, which "must not be taken for historical truths, but only for hypothetical and conditional reasonings better suited to clarify the Nature of things than to show their genuine origin" (1992, 19).

Rousseau's fantasy begins with "natural man" in an age of wild individualism. At this time, he says, people's only desires were physical—food, sleep, and sex. They did not live in families, much less larger social groups. An instinctive cry of nature provided some means of communication, but this was used only in emergencies, and humans had no everyday need for language. Tools were unnecessary, too:

The savage man's body being the only [instrument] he knows, he employs it for various uses of which . . . our bodies are incapable; our industry deprives us of the [force] and agility that necessity obliges him to acquire. If he had an axe, would his wrist break such strong branches? If he had a [slingshot], would his hand throw a stone so hard? If he had a ladder, would he climb a tree so nimbly? If he had a horse, would he run so fast? (Rousseau 1992, 21; translation modified)

In their natural state, Rousseau argues, humans were strong, self-sufficient, and happy.

Yet as the population grew and spread, people encountered rough weather and, for the first time, needed something outside of themselves. They needed fire—but also each other. In their new communities, people began to cook food, wear clothes, and build houses; they collaborated in activities like hunting and shared knowledge of new techniques and tools. With social pressure to communicate, the universal cry of nature gave way to conventional articulations of voice, to a kind of language. All of this created a new kind of human. In Rousseau's mind, it eventually separated savage people from civilized people, natural people from artificial people.

Rousseau's narrative proposes a common origin for language, society, and technics. Of course, as Jacques Derrida (1976, 199) observes, Rousseau's "origin" is not truly the beginning but "the beginning of the

end.” The “original” origin is always just out of reach, receding in a process of supplementary *différance*.² In other words, the origin of inequality, like original sin, is a second origin. It is natural man’s corruption by society and technics, a fall into artifice.

In *Technics and Time*, the French philosopher of technology Bernard Stiegler critiques Rousseau’s fiction by comparing it to another human origin story: the Greek myth of Prometheus and Epimetheus. When the gods created mortal creatures, these two brothers were given the important task of endowing the new beings with different qualities. Epimetheus would assign the qualities, and then Prometheus—the smarter brother—would inspect his work. Plato’s *Protagoras* recounts the myth:

To some creatures he [Epimetheus] gave strength, but not speed, while he equipped the weaker with speed. He gave some claws or horns, and for those without them he devised some other power for their preservation. To those whom he made of small size, he gave winged flight, or a dwelling underground; to those that he made large, he gave their size itself as a protection. And in the same way he distributed all the other things, balancing one against another. This he did to make sure that no species should be wiped out; and when he had made for them defenses against mutual destruction, he devised for them protection against the elements, clothing them with thick hair and tough skins, so as to withstand cold and heat . . . (1991, 13)

Yet Epimetheus made a foolish mistake. He used all of the qualities on animals, leaving nothing for people. When Prometheus came to inspect his brother’s work, he found humans naked and defenseless. They had no fur for warmth, no fangs for protection. Prometheus, of course, saved humanity by stealing from the gods. In Plato’s telling, he took not only fire but also *technē*. As Martin Heidegger (1977, 13) explains, “*Technē* is the name not only for the activities and skills of the craftsman, but also for the arts of the mind and the fine arts.” This divine know-how compensates for the humans’ lack of qualities and makes it possible for them to exist.

Technics, in this myth, does not supplement humanity; it is a *condition* of humanity. In Stiegler’s terms, the human pursues “life by means other than life,” through “organized inorganic matter.” For Rousseau, by contrast, humanity was originally self-sufficient and powerful, needing neither tools nor artificial techniques. Stiegler (1998, 114–15) observes that “Rousseau . . . wants to show that there is no originary default, no prostheses, that the claws missing in man are not stones, or, should they be stones, they are precisely not cut or fabricated, being immediately at hand and not inscribed in any process of mediation.” Besides claiming that the body is natural man’s only instrument, Rousseau (1992, 20) assumes that

natural man always walked on two legs, “using his hands as we do ours.” But here Stiegler (1998, 113) senses a contradiction, since we humans use our hands to manipulate tools, and this capacity for manipulation seems to distinguish hands from paws.

Here Stiegler invokes paleoanthropologist André Leroi-Gourhan (1911–1986). Considering early hominid fossils, Leroi-Gourhan (1993) argues that walking upright had profound effects on human evolution. It led to a bigger brain and a flexible vocal apparatus (see Mithen 2005, 147), and it freed the hands for gestural communication and tool use. From that point humans were co-evolving with their technology. This process was partially biological: human hands emerged in interaction with tools; the human digestive system emerged in interaction with cooked food; human toes in interaction with shoes. Yet technics also facilitated cultural evolution, the emergence of distinct social groups. Though many details in Leroi-Gourhan’s work are now out of date, the basic idea stands (see Odling-Smee, Laland, and Feldman 2003; and Malafouris 2013). Many scientists still link Paleolithic technology to “aspects of behavior, economy, mental capacities, neurological functions, the origin of grammatical language, and social and symbolic systems” (Ambrose 2001, 1752).

On this level, Stiegler argues against Rousseau, asserting that technics is originary to humanity, not supplementary. But in other ways, he agrees with Rousseau. The *Discourse on the Origin of Inequality*, for example, argues that natural man has no understanding of death, no understanding of temporality; natural man is supposedly immersed in “present existence without any idea of the future, however near it may be” (Rousseau 1992, 28). Human experiences of time, then, also begin with the second origin, with the development of tools and communities. This connection is explained by Stiegler’s central theses on technics and time—or, he would say, on technics *as* time. Technical objects represent an exteriorization of memory that outlasts the individual. This does not only happen with written records and other memory aids. Any technical object—say a stone handaxe or a bone flute—preserves traces of its users. Technics, then, provides access to a past through which we have not lived; it grounds the “historicality” (*Geschichtlichkeit*) of the world theorized by Heidegger (2010, 348–49). By forming the “already–there” into which we are inevitably thrown, technics makes cultural memory—and, indeed, culture itself—possible.

In sum, both Rousseau and Stiegler connect temporality, politics, and language to technology, to humanity’s relation to exteriority. Rousseau (1992, 66) asserts that “the Savage lives within himself; the sociable man, always outside of himself.” Stiegler, meanwhile, claims that this exteriority

constitutes the human. He concludes that “Rousseau’s narrative of the origin shows us through antithesis how everything of the order of what is usually considered specifically human is immediately and irremediably linked to an absence of property, to a process of ‘supplementation,’ of prosthetization or exteriorization, in which nothing is any longer immediately at hand, where everything is found mediated and instrumentalized, technicized, unbalanced . . . Rousseau will not, therefore, have been mistaken; he will have been right, *almost*” (Stiegler 1998, 133).

The Technicization of Voice

Stiegler’s critique is easily extended to Rousseau’s writings on musical origins.³ In his *Dictionary of Music* (1768), Rousseau (1998, 375) says that “Song does not seem natural to man. Although the Savages of America sing, because they speak, the true Savage never sang.” Song, like speech, emerged with the second origin, when the cry of nature was transformed through social conventions. For Rousseau, then, music starts not with sound but with the voice. Furthermore, according to the 1781 *Essay on the Origin of Languages*, speech and song did not simply originate at the same time. In the past, Rousseau (1998, 318) claims, “there was no music at all other than melody, nor any other melody than the varied sound of speech.”⁴ Today, though, speech no longer sings, and song no longer speaks. These dual aspects of the voice grew apart in a process of technicization that repeated the fall into artifice. Rousseau suggests that writing distanced language from the emotional presence of voice. With music, he attacks the bloodless conventionality of French opera, Jean-Philippe Rameau’s scientistic theories of harmony, and the denatured voices of castrati (see Derrida 1976, 195, 210–12; Christensen 1993; and Feldman 2008, 180).

For present purposes, though, I am more interested in the *Essay*’s reference to an earlier stage in the technicization of voice, a stage before harmony:

From the time of Menalippides and Philoxenus, instrumental players—who were at first the employees of the Poets and worked only under them and, so to speak, at their dictation—became independent of them . . . Thus melody, beginning to no longer be so attached to discourse, imperceptibly assumed a separate existence, and music became more independent of the words. That was also when the wonders that it had produced when it was only the accent and harmony of poetry gradually ceased . . . (Rousseau 1998, 329)

Here song is corrupted not by harmony but by instruments. Instrumental *mélodie* echoes vocal *chant*, while also distorting it (Waeber 2009, 109). Instruments supplement the voice, divorcing music from linguistic communication.⁵ They exteriorize, conventionalize, and constrain music, forming the eventual basis for harmony. “The system of the Greeks had absolutely no harmony in our sense,” Rousseau argues (1998, 328),

except what was required to tune instruments on perfect consonances. All peoples who possess stringed instruments are forced to tune them by consonances, but those who do not possess them have inflections in their songs which we call false because they do not enter into our system and because we cannot notate them.

Song can still imitate primal, passionate voices (and that, for Rousseau, is the source of whatever affective power it retains), but it is permanently “shackled” by the instrumental system.

This shackling may be illustrated with a moment from Rousseau’s most successful composition, *Le devin du village* (1752).⁶ The one-act opera begins with the shepherdess Colette, who is weeping because her lover, Colin, has abandoned her. (After the piece’s premiere at court, Louis XV reportedly sang this air all day [Robinson 1992].) When Colette exclaims “Alas! Alas!” her melody mirrors the falling inflection of an actual sigh (see Example 1). Yet Colette’s cry is also forced into the artificial steps of a chromatic scale. It is not continuous but discrete, divided according to the intervallic system of the keyboard and Western notation. Here Rousseau the composer gestures toward purer forms of vocalization—both the prelinguistic cry of nature and pre-instrumental speech-song—that civilized humans can never fully recover.

The image shows a musical score for a scene from Rousseau's *Le devin du village*. It features two staves: a vocal staff for Colette and a keyboard staff for the Orchestra. Colette's part is in G major, 4/4 time, and consists of a single melodic line with the lyrics "Hé - las! Hé - las!". The melody starts on a whole note G4, followed by a half note F#4, and then a quarter note E4, creating a falling inflection. The Orchestra part is in the same key and time, featuring a continuous accompaniment of triplets in the right hand and a simple bass line in the left hand. The right hand part consists of a series of eighth-note triplets, each starting on a different note of the chromatic scale, creating a sense of motion and tension.

Example 1: Rousseau, *Le devin du village*, “J’ai perdu tout mon bonheur,” mm. 43–46

Rousseau’s musical polemics, then, recapitulate his anthropological speculations: song has its own double origin in which voice was supplemented by instruments, immediate expression turned to technique, and

natural music gave way to artificial music. Again, the contradictions here are revealing. Rousseau imagines a voice before articulation and before conventions, even though the prominence of these features distinguishes human voices from animal vocalizations. As Rousseau (1998, 326) himself claims, “Birds whistle, man alone sings.” But from this perspective, there is no voice without vocal technique; technique constitutes the voice as such. Likewise, Rousseau idealizes a kind of song whose inflections are not constrained by intervals, even though intervallic spacing differentiates singing from expressive speech. Indeed, as Derrida (1976, 200) notes, Rousseau’s own definition of song in the *Dictionary of Music* invokes the interval, indicating that intervallic spacing is not extraneous to song but “an originary accessory and an essential accident.” In the end, it appears that music—like the human—emerges through mediation, exteriorization, and instrumentalization. Rousseau’s quest for musical immediacy ultimately points to musical technics.

Language, Tool Use, and Music

Twenty-first-century writers on music and evolution often echo Rousseau. Steven Brown’s (2000) theory of “musilanguage” and what Steven Mithen (2005) calls “HmMMM”—an acronym for “holistic, multi-modal, manipulative, musical, and mimetic” communication—both imagine a prehistoric form of vocal expression that would be equally protomusical and protolinguistic. Emotion is generally considered central to such communication (see Molino 2000, 171–72; Richman 2000; and Cross 2009). Furthermore, it aligns with the idea that “music is first and foremost vocal” (Molino 2000, 172. See also Lehmann 2010, 92). According to Nicholas Bannan (2012, 306), “vocal music, which arises directly from the potential of evolved anatomy, is far older than instrumental, which employs extra-somatic tools.” Musical instruments may then be conceived as a supplement to bodily musicality. For example, Ian Cross (2007, 663) understands instruments as “prosthetic devices,” “extending the sound-producing capacities of the human body (in terms of frequency range, intensity, and timbre).” Iain Morley (2013, 131) writes: “instruments constitute an accessory to existing human capacities; the origins of musical behaviour would not have relied upon the invention of instruments.”⁷ Of course, these writers’ methodological and theoretical commitments differ significantly from Rousseau’s, and the individual authors may not subscribe to all of these claims. Nonetheless, at each point the philosopher haunts contemporary discourse on musical origins.

These arguments often respond to perceived attacks from authors like Steven Pinker (1997, 534), who notoriously refers to music as evolutionary “cheesecake.” They aim to show that music is not merely a form of non-adaptive pleasure seeking (Huron 2001, 45–46). They suggest instead that music is in our nature (e.g., Levitin 2008). To this end, scholars adopt various strategies, considering social benefits of music making, vocalization in animals, musical universals, or connections between music, language, and other domains of human behavior.

Speech, song, and musilanguage, for example, would all rely on “vocal emancipation” (Merker 2012, 222), an advanced capacity for voluntarily reproducing and varying vocal sounds. But this leads back to technics. For, as Merlin Donald argues, the “self-programmed” motor skills needed for protolanguage also support tool use. “All gestures and intentional vocalizations are ultimately actions of the musculature,” Donald (1999, 141) writes, “and to generate greater varieties of gestures and sounds, primate motor behaviour must somehow have become much more plastic, less stereotyped, and subject to deliberate rehearsal.” As such, he concludes that language evolution would require “a breakthrough in hominid motor evolution” (141). The ability to consciously refine skills through practice and to imitate others’ actions would facilitate both communication and tool-based action, techniques of the body alone and techniques that incorporated external props. It would reflect the development of a mimetic system that would underlie “play, games, skilled rehearsal, nonlinguistic gesticulation, toolmaking, other creative instrumental skills, many nonsymbolic expressive devices used in social control, and reproductive memory in general” (Donald 1991, 193).

On a social level, mimetic skill would engender distinctively human forms of communication and cooperation based on shared intentionality (Donald 1991, 171). For Michael Tomasello (2008, 108), this is the central cognitive adaptation that distinguishes humans from other primates: unlike chimpanzees and other apes, we understand conspecifics as agents with intentions and feelings like our own. This distinction is crucial to humans’ “capacity for culture” (Tomasello 1999, 325). Tomasello’s evidence from primate and developmental psychology aligns suggestively with anthropological research by Tim Ingold. Drawing on ethnographic work with hunter-gatherer groups, Ingold (1993, 436–42) insists that the technical, like language, is always social and cooperative. Skill development is based in relationships between experts and novices (Ingold 2000, 37). It involves watching and copying, working or playing together. Tools, like gestures, then, already imply some intersubjective context of shared attention, understanding, and goals. In fact, an object is seen as a tool only when it is connected with some technique, some purpose (319).

This research strongly suggests that human capacities for gesture, language, and complex tool use—for communicative and material interventions in the world—evolved together. But the preconditions for the emergence of gesture, language, and complex tool use are equally preconditions for the emergence of singing and playing instruments.

The flutes of Hohle Fels demand practiced motor control and mimetic understanding. These instruments depended on the manual capacities that differentiated anatomically modern humans from other primates—mobile wrists, sturdy and flexible thumbs, and fleshy finger-pads. To borrow two terms from Raymond Tallis (2003), the flute was not just “brachio-chiral,” involving the reaching, gesturing hand at the end of the arm; it required the precision of the “chiro-digital.” Prehistoric flutists, like their modern counterparts, used their fingers, covering holes in different combinations to produce a range of pitches and coordinating such movements with the mouth and breath. As Jeremy Montagu (2003, 3) notes, this is not the easiest instrument to master: “with both end-blown and notch flutes, the player has to be careful to hold the instrument so that the air-stream impinges on the edge at precisely the right angle—otherwise there is only a hiss and no musical sound.” Stiegler (2009, 66–69) would further emphasize how these techniques combine somatic memory and technical memory, the interiorized memory of an individual and the exteriorized memory of the group.

Singing, too, requires muscular self-programming, and vocal skill, no less than tool use, is cultivated in some social context. All cultures have vocal music (Nettl 2000, 468), because the voice, as part of the body, is everywhere at hand. But there is no universal voice. As Curt Sachs (1961, 85) notes, “nowhere outside the modern West do people sing with a voice for which we have coined the honorific title of ‘natural.’” Singing always has an accent. The voice is always already technical.⁸ And so, in a sense, the musical voice has always been a mediated “vocal instrument.” This is not to ignore differences between instrumental and vocal practices, which are substantial, nor to collapse the distinction between techniques of tool use and “techniques of the body” (Mauss 1973). It is, instead, to point out a paradoxical interrelation of instrument and voice that resembles the relation between writing and speech: to paraphrase Derrida (1976, 46), the musical instrument is at the same time exterior to the voice, not being a mere imitation of voice, and interior to the voice, which is already in itself instrumentalized or technicized.

All of this implies that human vocal ability would not precede the ability to make music with objects. Any early human that could learn to sing could also learn to drum with sticks or stones. Indeed, the capacity

to perceive and produce rhythms—with hands, feet, voices, or tools—is a key example of mimetic skill (Donald 1991, 186–87). Of course, the *playing* of instruments, in this view, does not necessarily coincide with the *making* of instrumental artifacts. After all, communities of hunter–gatherers today often use found objects as musical instruments (Espí-Sanchis and Bannan 2012). Or perhaps the primordial act of instrument making is simply the taking–up of an object as a means to music, the act of connecting a thing, whether found or fashioned, with some musical technique.

Coda

Again Rousseau will have been right, *almost*. On this account, song and speech, voice and tools would have a common origin. Vocal and instrumental skill would both be features of a musicality that is deeply entwined with the human capacity for culture (Cross 2008)—a capacity, in other words, for technics. While reassessing claims for vocal precedence in terms of technics can help today’s scholars avoid Rousseau’s metaphysical assumptions (that is, his “phonocentrism”), it can also bring narratives of musical origins into better accord with perspectives on human cognitive evolution from Donald, Tomasello, and others.

If voice and instrument are not opposed in a metaphysical binary, they may interact more freely. Just as flutes may imitate voices, voices may imitate flutes or drums. David Burrows (2007, 90) even suggests that “stability of pitch in singing . . . could conceivably result simply from imitating the behavior of xylophones and other such instruments in which pitch level is built in.” Interplay between vocal instruments and instrumental voices appears in countless repertoires—from jazz vocalise to pianistic cantabile, from *konnakol* vocal percussion in South-Indian classical music to the “mouth music” of eighteenth-century Scotland. Briefly consider a more recent example: beat-boxing often incorporates song and speech but is irreducible to either. The word “beat-box,” now a verb, originally referred to the drum machine itself. Beat-boxers virtuosically interiorize the machine’s rhythms, incorporating drum sounds into their bodies, their voices. Beside Mithen’s “singing Neanderthals,” then, it might be useful to imagine “beat-boxing Cro-magnons.” Vocal percussion might be just as old as song.

Beat-boxing represents an instrumental mediation of voice that is grounded in technologies of sound reproduction. Yet before CDs or LPs, even before musical notation, musical instruments (including techni-

cized voices) and their associated gestural programs help preserve musical materials. They contribute to the kind of technical memory theorized by Stiegler, as forms of inscription or “recording” that ground musical culture (see Gallope 2011, 61). Making music repeatable, such mediation builds associations that direct future perception (Stiegler 2011, 17–21). It shapes a musical “already–there.” This helps explain Stiegler’s radical claim, made while he was director of the French music research institute IRCAM, that there is no music without instruments (Donin and Stiegler 2004, 7). This is to say, there is no music without technics.

From this perspective, Steven Pinker might, like Rousseau, be *almost* right. Pinker (1997, 529) writes that music, alongside art, religion, and philosophy, “is a technology, not an adaptation.”⁹ Saying that music is not adaptive does not mean that it is not functional, that it does not benefit individuals and communities who make it (see Fitch 2006); it would mean that music was not created through the competition of “selfish genes.” Arguments for music’s evolutionary significance, adaptive or otherwise, can easily replicate a dualistic metaphysics, trying to prove that music is natural not artificial for humanity. This essay suggests that it may be more productive to start from music’s technicity, considering the co–constitution of instrument and voice, tool and technique. Ultimately this points to an ontological proposition demanding further thought. What if music is not simply produced *via* technology? What would it mean for music itself *to be* a form of technics?¹⁰

Notes

An earlier version of this paper was presented at the 2011 Meeting of the Society for Music Theory in Minneapolis, as part of a special session organized by the SMT Music and Philosophy Interest Group. I wish to thank Michael Gallope, Berthold Hoeckner, Brian Kane, Jairo Moreno, Lawrence Zbikowski, and the journal’s editorial board for their comments.

1. Reports about the Hohle Fels flutes in the popular press include Allen 2009, Devlin 2009, and Ghosh 2009. Though an older bone artifact was once thought to be a Neanderthal flute (see Kunej and Turk 2000), microscopic analysis reveals that its holes were not manufactured by humans but were produced by carnivore teeth (d’Errico and Villa 1997; and d’Errico and Lawson 2006). On more recent dating of musical artifacts, see Higham et al. 2012.

2. The Derridean term *différance* is, characteristically for this philosopher, a pun. It encompasses two meanings of the French *différer*, both “to differ” and “to defer” (see Derrida 2011, 75).

3. Stiegler (1998, 116) does not investigate questions of vocality here, simply noting that Rousseau’s natural man “does not exteriorize himself, does not ex–press himself, does not speak: speech is already a prosthesis.”

4. Here Rousseau (1998, 318) mentions a classical source, Strabo’s *Geography*, which assumes a common origin for poetry and song (see Strabo 2014, 50–51).

5. Instrumental supplements are considered in recent philosophical work on voice: see Cavarero (2005, 68) on the flute of Marsyas, and Dolar (2006, 52–56) on the shofar. It is interesting that these examples involve wind instruments, which Rousseau (1998, 440) thought to be the earliest type of instrument.
6. For discussion of Rousseau's musical career, including analysis of idiosyncratic passages from *Le devin du village*, see Gjerdingen 2007.
7. Christian Lehmann (2010, 101–2) even argues that musical instruments did not truly develop until the invention of ancient Greek music theory.
8. For further discussion of the singing voice as technology, see Eidsheim 2008.
9. Pinker (1994) believes that language is an evolutionary adaptation, a claim that is highly debatable (see Huron 2001, 44; and Sampson 2005). Accordingly, Pinker (1997, 534) privileges language over music, claiming that music may be partially founded on pre-established linguistic abilities.
10. For a response to Pinker that considers music as “transformative technology,” see Patel 2008, 400–401.

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